

## Claims

1. A display apparatus comprising:

a display section (1) disposing a plurality of lighting elements (11);

a vertical driving section (2), which can connect with each of the lighting

5 elements (11) disposed in a row of the display section (1) selectively and performs impressing current to each of the lighting elements (11) connected in a selected row with switching every row in vertical direction;

a plurality of horizontal driving sections (3), which is connected in column direction of the display section (1), providing lighting elements (11) 10 connected in the selected row of the display section (1) by the vertical driving section (2) with current based on input data for the lighting elements (11) of each column;

a driving control section (4), which receives various control data from external and performs a lighting control of the lighting section (1) with 15 synchronizing the vertical driving section (2) and the horizontal driving section (3) based on the control data; and

a first communicating section (5) communicating the various control data with external,

wherein:

20 the driving control section (4) has a second communicating section (6) communicating data with each of the horizontal driving section (3);

each of the horizontal driving section (3) has a horizontal driving communicating section (8) communicating data with the second communicating section (6) and among the horizontal driving sections (3);

25 individual identification information (23) to discriminate the horizontal driving section (3) is set to each of the horizontal driving sections (3);

the data transferred to each of the horizontal driving section (3) is formatted in predetermined format with adding the identification information (23);

30 the second communicating section (6) of the driving control section (4) transfers the data to the horizontal driving communicating section (8) of each of

the horizontal driving sections (3); and

the horizontal driving communicating section (8) performs a lighting control of the lighting elements (11).

5 2. A display apparatus comprising:

a display section (1) disposing a plurality of lighting elements (11);

a vertical driving section (2) driving each row of the display section (1) selectively;

10 a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating various control data, and driving to control lighting gradation based on the various control data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2); and

15 a driving control section (4) having a first communicating section (5) to communicate the various data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3),

wherein:

20 the second communicating section (6) transfers data packets having a control field (21) including identification information (23), which is the ID to denote the horizontal driving sections (3) to be transferred the various control data, control identification information (24) to denote type of the control data, and an information field (22) including the control data to the horizontal driving sections (3); and

25 the horizontal driving communicating section (8) receives the control data for the horizontal driving section (3), when the ID of identification information of the transferred data packet (20) agrees with ID stored in itself.

30 3. The display apparatus according to claims 1 or 2, wherein

the horizontal driving section (3) stores a common ID to be received

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commonly for all of the horizontal sections (3) and the individual ID added individually to each of the horizontal sections (3) as identification information (23) to judge whether to perform a receiving process for the transferred data packet (20).

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4. The display apparatus according to any of claims 1-3, wherein  
the horizontal driving communicating section (8) has a receiving section (28) performing receiving process and an output selecting circuit (30) outputting the various control data input into the horizontal driving communicating section 10 (8) and data input from the receiving section (28) selectively, outputs the control field (21) of the input data packet (20) transparently from the output selecting circuit (30), and outputs the information field (22) with replacing for a predetermined data packet (20).

15 5. The display apparatus according to claim 4, wherein:

the predetermined data packet (20) is a disturbance data reading packet (20B) having the identification information (23), the control field (21) including control identification information (24) denoting to read a disturbance data, and the information field (22) including dummy data (22B);

20 the horizontal driving communicating section (8) further has a disturbance data retaining section (29) retaining the disturbance data its own and outputs the disturbance data retained in the disturbance data retaining section (29) with replacing dummy data included in the control field (22) of the disturbance data reading packet (20B) received in the receiving section (28) of 25 the horizontal driving section (3) with switching the output selecting circuit (30), when the identification information (23) of the data packet (20) received in the receiving section (28) of the horizontal driving section (3) agrees with its own individual ID and has the control identification information (23) denoting control type to read a disturbance data; and

30 the driving control section (4) reads the disturbance data of the disturbance reading packet (20B) transferred from the horizontal driving section

(3).

6. The display apparatus according to claim 4, wherein:

the predetermined data packet (20) is a communication check packet

5 (20C) having the identification information (23), the control field (21) including control identification information (24) denoting communication check, and the information field (22) including communication check data;

the horizontal driving communicating section (8) further has a data reversing section (38) reversing data of the information field (22);

10 and outputs data from the data reversing section (38) with replacing communication check data included in the information field (22) of the communication check packet (20C) received in the receiving section (28) of the horizontal driving section (3) with switching the output selecting circuit (30), when the identification information (23) of the data packet (20) received in the 15 receiving section (28) of the horizontal driving section (3) agrees with its own individual ID and has the control identification information (23) denoting control type of communication check; and

the driving control section (4) performs disturbance check of communication statement based on the data included in the information field 20 (22) of each communication check packet (20C) replied from each horizontal driving section (3) and the communication check data of the communication check packet (20C) transferred to each horizontal driving section (3).

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*OB2*  
25 7. The display apparatus according to any of claims 1-6, wherein:

the horizontal driving communicating section (8) of the horizontal driving section (3) can output only in one direction; and

the output data from the horizontal driving communicating section (8) connected at end position of the lowest stream in data transferring direction in a plurality of the horizontal driving position (3) connected serially is input to the 30 second communicating section (6) of the driving control section (4).

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8. The display apparatus according to claims 1 or 2, wherein:

the driving control section (4) or the horizontal driving section (3) has a first reference clock generating section (7) generating first reference clock to control lighting gradation; and

5 the horizontal driving section (3) further has a lighting control section (15) controlling lighting gradation based on reference clock, a second reference clock generating section (19) generating second reference clock synchronizing the various control data input from the driving control section (4), a reference clock selecting circuit (36), which is input the first reference clock and the 10 second reference clock, and selects the first reference clock or the second reference clock alternatively to output as reference clock to control lighting gradation.

9. The display apparatus according to claim 8, wherein:

15 the horizontal driving section (3) further has a first counter (33) counting input of the first reference clock and generating a clear signal every predetermined count number;

a second counter (34) counting input of the second reference clock until being input the clear signal from the first counter (33); and

20 the reference clock selecting circuit (36) selects the reference clock from the first reference clock to the second reference clock, when count number of the second counter becomes higher than predetermined value.

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10. The display apparatus according to any of claims 5-8, wherein:

25 the horizontal driving section (3) has a third counter (40) counting input of the first reference clock and retaining predetermined data when count number of the input first reference data becomes a predetermined value, and clearing the count number of the first reference clock when the horizontal driving communicating section (8) receives a frame start packet denoting frame 30 synchronizing;

the disturbance data retaining section (29) retains data denoting

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~~occurrence of disturbance of the first reference clock, when count number of the third counter is less than the predetermined value; and~~

~~the driving control section (4) reads the data denoting an occurrence of disturbance of the first reference clock by the disturbance data reading packet (20B), controls the reference clock selecting circuit (36) of the horizontal driving section (3) occurring the disturbance to select from the first reference clock to the second reference clock by the data packet (20).~~

11. The display apparatus according to claim 10, wherein the predetermined value of the count number of the first reference clock is set based on indicating gradation number of one frame.

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12. The display apparatus according to any of claims 1-11, further comprising:  
a substrate is integrated with a lighting element board (41) disposing the lighting elements (11) and a driving circuit board (42) having driving circuits (10) driving the lighting elements (11), and  
wherein the driving circuits (10) are disposed between the lighting elements.

20 13. A display apparatus comprising:  
a display section (1) disposing a plurality of lighting elements (11);  
a vertical driving section (2) driving each row of the display section (1) selectively;  
a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating various control data, driving to control lighting gradation based on the various control data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2); and  
a driving control section (4) having a first communicating section (5) to communicate the various data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3)

serially, and controlling the vertical driving section (2) and the horizontal driving sections (3), wherein:

the horizontal driving sections (3) are connected each other by signal lines and can communicate the data with the driving control section (4);

5 the driving control section (4) adds identification information (23) to transferred control data to each horizontal driving section (3) corresponding to connecting formation of the horizontal driving sections (3) in the display section (1) and transfers various control data; and

10 the horizontal driving sections (3) perform a lighting control of the lighting elements (11).

14. The display apparatus according to claim 13, wherein:

the driving control section (4) further has a identification information storing section (25) storing IDs added to the horizontal driving sections (3) according to order to transfer the control data to the horizontal driving section (3) corresponding to path of the signal lines connecting the horizontal driving sections (3) each other; and

20 the driving control section (4) transfers the control data input from external with adding the IDs read from the identification information storing section (25) corresponding to each horizontal driving section (3) one after another to the horizontal driving sections (3) in data packet format.

15. A display apparatus comprising:

a display section (1) disposing a plurality of lighting elements (11);

25 a vertical driving section (2) driving each row of the display section (1) selectively;

30 a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating various control data, driving to control lighting gradation based on the various control data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2); and

a driving control section (4) having a first communicating section (5) to communicate the various data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3), wherein:

the horizontal driving communicating sections (8) of the horizontal driving sections (3) has a horizontal driving side identification information storing section (29) storing identifying ID (23a) denoting ID of each the horizontal driving section (3); and

the identifying ID (23a) of each the horizontal driving section (3) stored in the horizontal driving side identification information storing section (29) is set to deferent identifying IDs (23a) from the horizontal driving section (3) connected with the second communicating section (6) side one after another based on a predetermined calculation.

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16. The display apparatus according to claim 15, wherein:

the horizontal driving communicating section (8) of the horizontal driving section (3) has a receiving section (28) inputting and outputting data, a output selecting circuit (30) outputting data input to the horizontal driving section (3) or the data output from the receiving section (28) selectively;

when setting command to set the ID of the horizontal driving section (3) is input, the horizontal driving communicating sections (8) controls to switch the data output of the output selecting circuit (30) from the data input to the horizontal driving section (3) to the data output through the receiving section (28); and

to store the identifying ID (23a) input to the receiving section (28) to the horizontal driving side identification information storing section (29) and to output a identifying ID (23a), which is performed the predetermined calculation against the identifying ID (23a) input to the receiving section (28) from the output selecting circuit (30).

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17. The display apparatus according to claim 15, wherein:

the horizontal driving communicating sections (8) of the horizontal driving section (3) has a receiving section (28) inputting and outputting data, a output selecting circuit (30) outputting data input to the horizontal driving section

5 (3) or the data output from the receiving section (28) selectively;

when setting command to set the ID of the horizontal driving section (3) is input, the horizontal driving communicating sections (8) controls to switch the data output of the output selecting circuit (30) from the data input to the horizontal driving section (3) to the data output through the receiving section (28); and

to store a identifying ID (23a), which is performed the predetermined calculation against the identifying ID (23a) input to the receiving section (28), to horizontal driving side identification information storing section (29) and to the identifying ID performed the predetermined calculation from the output selecting circuit (30).

18. The display apparatus according to claim 15, wherein the horizontal driving communicating sections (8) of the horizontal driving section (3) controls to switch the data output of the output selecting circuit (30) from the data through the receiving section (28) to the data input to the horizontal driving section (3) after outputting the identifying ID (23a) performed the predetermined calculation from the output selecting circuit (30).

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19. The display apparatus according to any of claims 13-15, wherein:

the display section is constituted by a plurality of indicating blocks (10) divided into m rows X n columns (m, n are integer and two or more) areas;

the horizontal driving sections (3) are connected from the second communicating section (6) side one after another toward horizontal direction serially; and

30 the horizontal driving section (3) connected at end column of the lowest stream in each row is connected with the horizontal driving section (3) of

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the same column in next row.

20. The display apparatus according to any of claims 13-19, wherein:

5        the horizontal driving section (3) judges whether to perform a receiving process against the transferred data packets based on the identification information (23) added to the data packets or not, by storing an individual ID (23A), which is added to each horizontal driving section (3) individually, to the horizontal driving side identification information storing section (29); and

10      the horizontal driving section (3) stores a common ID (23B) to be received by all of the horizontal driving sections (3) commonly.

21. The display apparatus according to any of claims 1-20, wherein a plurality of the lighting elements (11) are disposed in a matrix shape in the display section (1).

15      22. The display apparatus according to any of claims 1-21, wherein the control data is image data for image-displaying.

20      23. The display apparatus according to any of claims 1-21, wherein the control data is illuminating data for an illumination.

25      24. A display driving circuit driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11), comprising:

selectively;

26      a vertical driving section (2) driving each row of the display section (1)

30      a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements, performing light-driving based on the lighting data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2); and

31      a driving control section (4) having a first communicating section (5) to

communicate the lighting data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3), wherein:

- 5       the horizontal driving sections (3) are added IDs to discriminate themselves;

the second communicating section (6) transfers data packets having control field (21) including identification information (23), which is the ID to discriminate the horizontal driving section (3) to be transferred the lighting data, 10 and control identification information (24) to denote type of the lighting data, and information field (22) including the lighting data to the horizontal driving sections (3); and

15       the horizontal driving communicating section (8) receives the lighting data for the horizontal driving sections (3), when the ID of identification information (23) of the transferred data packet (20) agrees with ID added to itself.

25. A display driving circuit driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11) and a vertical driving section (2) driving each row of the display section (1) selectively, comprising:  
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a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements, performing light-driving based on the lighting data with selecting the lighting elements of desired columns in a row selected by the 25 vertical driving section (2); and

a driving control section (4) having a first communicating section (5) to communicate the lighting data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving 30 sections (3), wherein,

the horizontal driving sections (3) are added IDs to discriminate

themselves;

the second communicating section (6) transfers data packets having control field (21) including identification information (23), which is the ID to discriminate the horizontal driving sections (3) to be transferred the lighting data, 5 and control identification information (24) to denote type of the lighting data, and information field (22) including the lighting data to the horizontal driving sections (3); and

the horizontal driving communicating section (8) receives the lighting data for the horizontal driving sections (3), when the ID of identification 10 information (23) of the transferred data packet (20) agrees with ID added to itself.

26. A display driving circuit driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11), a vertical driving section (2) driving each row of the display section (1) selectively, and a plurality 15 of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements, performing light-driving based on the lighting data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2), 20 comprising:

a driving control section (4) having a first communicating section (5) to communicate the lighting data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving 25 sections (3), wherein:

the horizontal driving sections (3) are added IDs to discriminate themselves;

the second communicating section (6) transfers data packets having control field (21) including identification information (23), which is the ID 30 to discriminate the horizontal driving sections (3) to be transferred the lighting data, and control identification information (24) to denote type of the lighting

data, and information field (22) including the lighting data to the horizontal driving sections (3); and

the horizontal driving communicating section (8) receives the lighting data for the horizontal driving sections (3), when the ID of identification information of the transferred data packet (20) agrees with ID added to itself.

27. A display driving circuit driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11), comprising:

a vertical driving section (2) driving each row of the display section (1) selectively;

a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements, performing light-driving based on the lighting data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2); and

a driving control section (4) having a first communicating section (5) to communicate the lighting data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3), wherein:

the horizontal driving sections (3) are connected each other by signal lines and can communicate the data with the driving control section (4);

the driving control section (4) adds identification information (23) to transferred lighting data to each horizontal driving section (3) corresponding to connecting formation of the horizontal driving sections (3) in the display section (1) and transfers the lighting data;

the horizontal driving sections (3) perform a lighting control of the lighting elements (11);

the driving control section (4) further has a identification information storing section (25) storing IDs added to the horizontal driving section (3) according to order to transfer the lighting data to the horizontal driving section

(3) corresponding to path of the signal line connecting the horizontal driving sections (3) each other; and

the driving control section (4) transfers the lighting data transferred from external with adding the IDs read from the identification information storing section (25) corresponding to each horizontal driving section (3) one after another to the horizontal driving sections (3) in data packet format.

28. A display driving circuit driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11) and a vertical driving section (2) driving each row of the display section (1) selectively, comprising:

a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements, performing light-driving based on the lighting data with selecting the lighting elements (11) of desired columns in a row selected by the vertical driving section (2); and

a driving control section (4) having a first communicating section (5) to communicate the lighting data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3), wherein:

the horizontal driving sections (3) are connected each other by signal line and can communicate the data with the driving control section (4);

the driving control section (4) adds identification information (23) to transferred lighting data to each horizontal driving section (3) corresponding to connecting formation of the horizontal driving sections (3) in the display section (1) and transfers the lighting data;

the horizontal driving sections (3) perform a lighting control of the lighting elements (11);

the driving control section (4) further has a identification information storing section (25) storing IDs added to the horizontal driving section (3) according to order to transfer the lighting data to the horizontal driving section

(3) corresponding to path of the signal line connecting the horizontal driving sections (3) each other; and

the driving control section (4) transfers the lighting data input from external with adding the IDs read from the identification information storing section (25) corresponding to each horizontal driving section (3) one after another to the horizontal driving sections (3) in data packet format.

29. A display driving circuit driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11), a vertical driving section (2) driving each row of the display section (1) selectively, and a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements, performing light-driving based on the lighting data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2), comprising:

a driving control section (4) having a first communicating section (5) to communicate the lighting data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3), wherein:

the horizontal driving sections (3) are connected each other by signal line and can communicate the data with the driving control section (4);

the driving control section (4) adds identification information (23) to transferred lighting data to each horizontal driving section (3) corresponding to connecting formation of the horizontal driving sections (3) in the display section (1) and transfers the lighting data;

the horizontal driving sections (3) perform lighting control of the lighting elements (11);

the driving control section (4) further has a identification information storing section (25) storing IDs added to the horizontal driving section (3) according to order to transfer the lighting data to the horizontal driving section

(3) corresponding to path of the signal line connecting the horizontal driving sections (3) each other; and

the driving control section (4) transfers the lighting data input from external with adding the IDs read from the identification information storing

5 section (25) corresponding to each horizontal driving section (3) one after another to the horizontal driving sections (3) in data packet format.

30. A method for driving a display apparatus, which has a display section (1) disposing a plurality of lighting elements (11), a vertical driving section (2) 10 driving each row of the display section (1) selectively,

and a plurality of horizontal driving sections (3), which have horizontal driving communicating sections (8) communicating lighting data for lightening the lighting elements and perform light-driving based on the lighting data with selecting the lighting elements of desired columns in a row selected by the 15 vertical driving section (2), are connected each other by signal line and can communicate the data with a driving control section (4), comprising:

a step that the driving control section (4) stores IDs added to the horizontal driving section (3) corresponding to path of the signal line connecting the horizontal driving sections (3) each other;

20 a step that the driving control section (4) adds IDs identifying the horizontal driving sections (3) to the horizontal driving sections (3);

a step that the driving control section (4) transfers the lighting data input from external with adding the stored IDs corresponding to each horizontal driving section (3) one after another to the horizontal driving sections (3) in data 25 packet format; and

a step that the horizontal driving sections (3) receive the data packet for itself and perform a predetermined process, and then transfer the data to the horizontal driving section (3) connected next or the driving control section (4).

30 31. A driving circuit of an image display apparatus comprising:

(a) the driving circuit of the image display apparatus having

a display section (1) disposing a plurality of lighting elements (11) in a matrix shape,

a vertical driving section (2) driving each row of the display section (1) selectively,

5 a plurality of horizontal driving sections (3) having horizontal driving communicating sections (8) communicating various control data including image data, driving to control lighting gradation based on the various control data with selecting the lighting elements of desired columns in a row selected by the vertical driving section (2),

10 a driving control section (4) having a first communicating section (5) to communicate the various data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3); and

15 (b) the second communicating section (6) transfers data packets having control field (21) including identification information (23), which is the ID to denote the horizontal driving sections (3) to be transferred the various control data, and control identification information (24) to denote type of the control data, and information field (22) including the control data to the horizontal  
20 driving sections (3),

the horizontal driving communicating section (8) receives the control data for the horizontal driving sections (3), when the ID of identification information of the transferred data packet (20) agrees with ID stored in its own.

25 32. A driving circuit of an image display apparatus comprising:

(a) the driving circuit of the image display apparatus having  
a display section (1) disposing a plurality of lighting elements (11) in a matrix shape,

a vertical driving section (2) driving each row of the display section (1)  
30 selectively,

a plurality of horizontal driving sections (3) having horizontal driving

communicating sections (8) communicating various control data including image data, driving to control lighting gradation based on the various control data with selecting the lighting elements (11) of desired columns in a row selected by the vertical driving section (2),

5       a driving control section (4) having a first communicating section (5) to communicate the various data with external and a second communicating section (6) connected with a plurality of the horizontal driving sections (3) serially, and controlling the vertical driving section (2) and the horizontal driving sections (3),

10      (b) the horizontal driving sections (3) are connected each other by signal line and can communicate the data with the driving control section (4),

          the driving control section (4) adds identification information (23) to transferred control data to each horizontal driving section (3) corresponding to connecting formation of the horizontal driving sections (3) in the display section

15      (1) and transfers the various control data, and

          the horizontal driving sections (3) perform lighting control of the lighting elements (11),

20      (c) the driving control section (4) further has a identification information storing section (25) storing IDs added to the horizontal driving section (3) according to order to transfer the control data to the horizontal driving section (3) corresponding to path of the signal line connecting the horizontal driving sections (3) each other; and

25      (d) the driving control section (4) transfers the control data input from external with adding the IDs read from the identification information storing section (25) corresponding to each horizontal driving section (3) one after another to the horizontal driving sections (3) in data packet format.